

National Personal Protective Technology Laboratory

Evaluation of High-Flow Filter Efficiency Testers for PAPR

Policy and Standards Development Branch

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Evaluation of High-Flow Filter Efficiency Testers for PAPR

- **Project Description – Planned Activities**
 - **Evaluate Air Techniques International (ATI) Model TDA-500P and TSI, Inc. (TSI) Model 3120 High-Flow Filter Efficiency Testers for use in PAPR95 and PAPR100 particulate filter efficiency level determination testing**
 - **Identify High-Flow Filter Efficiency Tester(s) acceptable for the required testing**
 - **Formulate Standard Test Procedure for Particulate Filter Efficiency Level Determination Testing for PAPR and Operating Procedure(s) for acceptable High-Flow Filter Efficiency Tester(s)**

Evaluation of High-Flow Filter Efficiency Testers for PAPR

- **Project Goals – Specific Testing for Each High-Flow Filter Efficiency Tester**
 - **Verify high-flow filter efficiency testers conform to advertised specifications and PAPR Standard**
 - **Determine DOP aerosol loading as a function of time at flow rates ranging from 100 to 500 Lpm**
 - **Determine the time required to load 1000 mg of DOP aerosol**
 - **Determine the DOP aerosol particle size distribution at flow rates ranging from 100 to 500 Lpm**
 - **Identify lab technician issues**

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- **Operating requirements for ATI and TSI High-Flow Filter Efficiency Testers**
 - **Additional compressed air required to accommodate higher flow rates**
 - **Compressed Air Requirements:**
 - **ATI: 18 scfm at 80 psig**
 - **TSI: 25 scfm at 100 psig**

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- **Operating requirements for ATI and TSI High-Flow Filter Efficiency Testers (cont.)**
 - **Vacuum pump required to overcome higher pressure drop across filter test bed and DOP discharge filter due to higher flow rates**
 - **Vacuum Requirements:**
 - **ATI: 22.5 acfm at 19 inches Hg**
 - **TSI: 25 acfm at 7.5 inches Hg**

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- **Operating requirements for ATI and TSI High-Flow Filter Efficiency Testers (cont.)**
 - Higher exhausting capabilities required due to higher flow rates
 - **DOP Aerosol Exhaust Requirements:**
 - **ATI: 48 scfm**
 - **TSI: 25 scfm**
 - **ATI exhaust requirements higher than TSI due to DOP aerosol carryover venting**

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- **ATI TDA-500P High-Flow Filter Efficiency Tester**



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- **TSI 3120 High-Flow Filter Efficiency Tester**

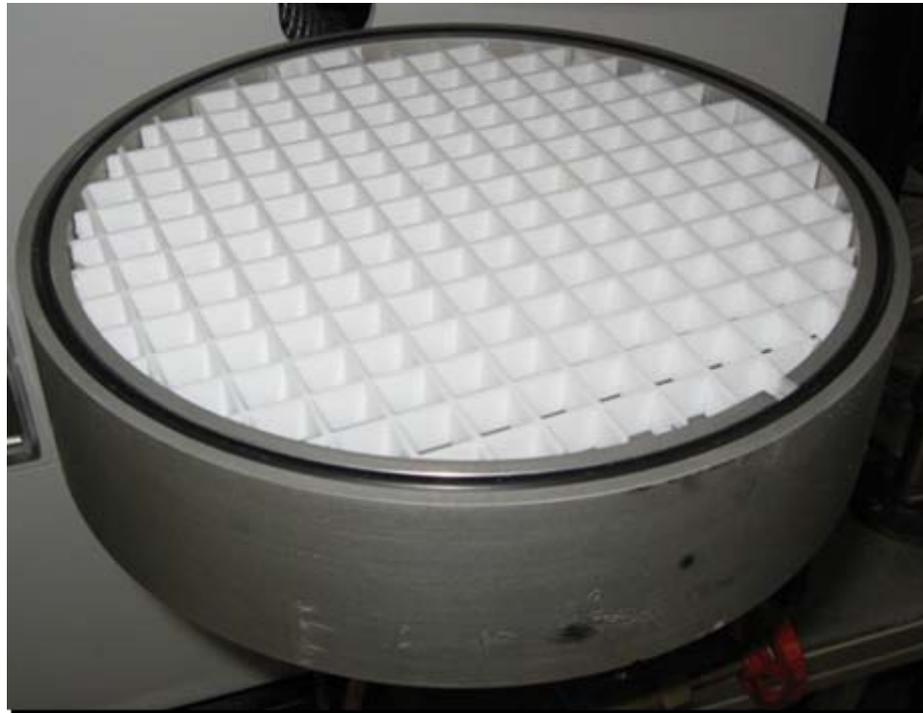


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- **DOP Aerosol Loading Measurements**
 - Determination of DOP aerosol loadings required an enlargement of the filter test bed to approximately 8-1/2 inches in diameter:
 - Reduce the pressure drop at the higher flow rates
 - Collect sufficient DOP aerosol to obtain accurate change in weight measurements
 - Type A/E glass fiber filters, 265-mm in diameter, are being used for collection of the DOP aerosol
 - A support grid, with 1/2-inch X 1/2-inch openings and a 1/16-inch thick lattice is being used to support the filter and prevent filter blowout

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- **ATI TDA-500P High-Flow Filter Efficiency Tester**
 - 8-1/2-inch in diameter filter test bed with support grid

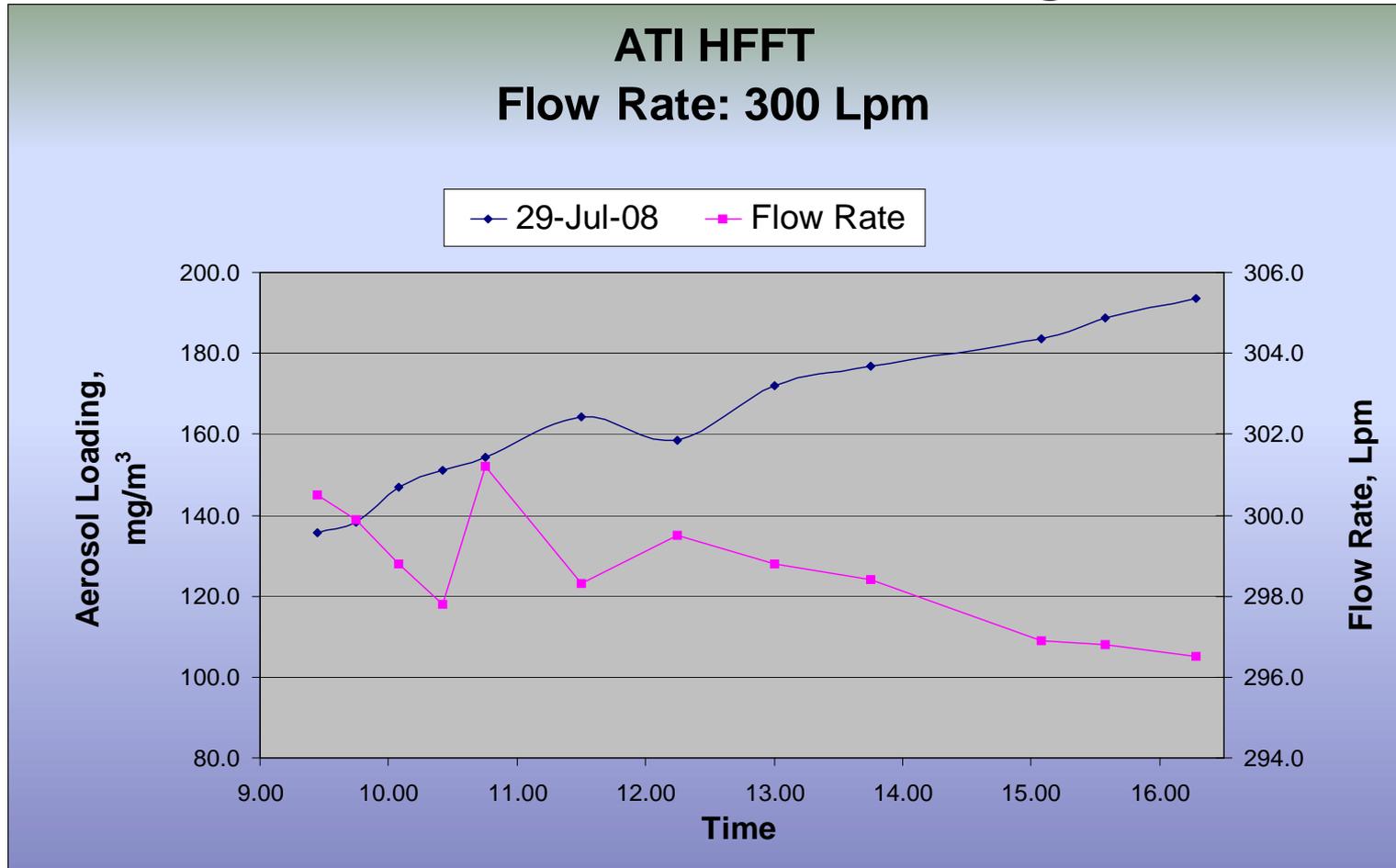


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- **Flow Rate Effect on DOP Aerosol Loading**
 - Initial testing indicates DOP aerosol loading is dependent on flow rate
 - Recent testing employing a hand valve to control the flow rate resulted in an improvement in the repeatability and consistency of DOP aerosol loading measurements from run to run
 - Mass flow controllers installed in place of existing mass flow meters would improve aerosol loading stability

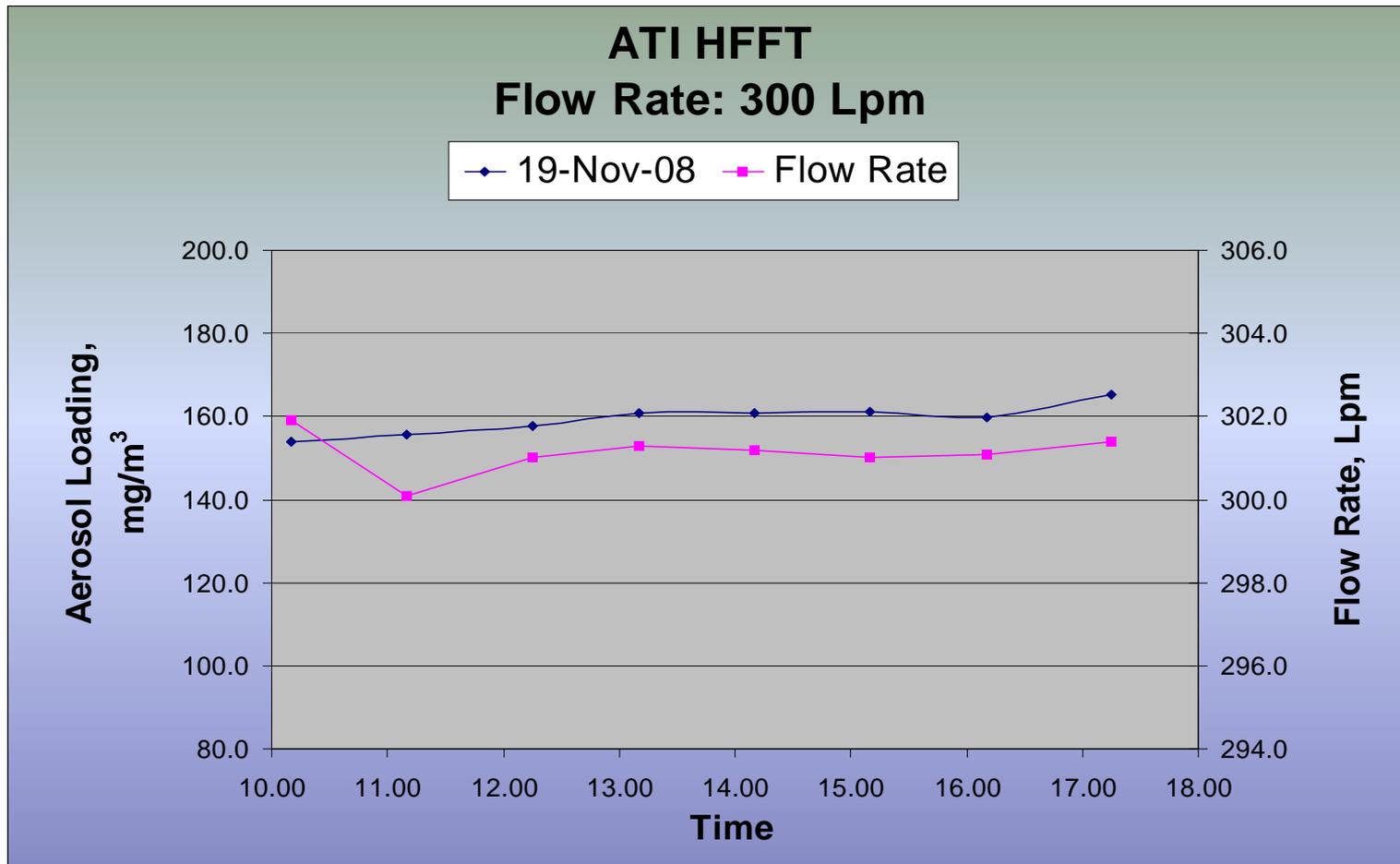
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- Flow Rate Effect on DOP Aerosol Loading – No Flow Control



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- Flow Rate Effect on DOP Aerosol Loading – Flow Control



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- **Vacuum Pump Noise Generation**
 - **With the vacuum pump close coupled to high-flow filter efficiency tester, noise level in test lab is high**
 - **Vacuum pump should be located remotely for commercial models**
 - **Vacuum pump noise may be mitigated by sizing the vacuum pump to final PAPR standard gas flow rate requirements and the PAPR test application**

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- **Waste Gas Venting**
 - **Higher flow rates result in higher waste gas flow rates that need to be exhausted from the test area through a controlled ventilation system such as a ventilated hood**
 - **ATI and TSI High-Flow Filter Efficiency Tester aerosol carrier gas is filtered upstream of vacuum pump to remove DOP before venting**
 - **ATI High-Flow Filter Efficiency Tester requires secondary exhaust to balance excess DOP aerosol generation from aerosol generator vent, resulting in higher waste gas venting requirements**
 - **TSI High-Flow Filter Efficiency Tester vents directly from aerosol generator**